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RAISED BILL No. S.B. 126 AN ACT ADDING WOOD SMOKE TO THE PUBLIC HEALTH NUISANCE CODE AND CONCERNING OUTDOOR WOOD-BURNING FURNACES.

To Chairs Senator Ed Meyers, Representative Richard Roy and members of the Environment Committee: Outdoor wood furnaces must be banned immediately.

My name is David R. Brown ScD, I am Public Health Toxicologist for Environment and Human Health, Inc., (EHHI) a non-profit organization comprised of physicians, public health professionals and policy experts

As an expert in the field, I am here to warn that the use of Outdoor Wood Burning Furnaces (OWFs) must be banned to protect health.

The immediacy of the OMF health problem is shown by the high levels of wood smoke emissions measured inside neighboring houses. EHHI has conducted an extensive study that measured potential wood smoke inhalation by persons living in homes that were in the vicinity of OWFs.

Two of the most hazardous components of wood smoke - particulate matter measuring 2.5, and smaller, and particulate matter 05 were significantly elevated inside homes near outdoor wood furnaces. High levels were present in every 24 hour period tested in every home.

The charts attached to my written testimony document that the wood smoke particulate exposures in every impacted home is extreme. The level of smoke in the impacted houses is several times higher than in the seven control houses that we tested in Connecticut.

Emissions from the OWFs are entering neighboring homes at all hours of the day and night and contaminating inside air, particularly at nighttime when residents are asleep. In addition to the particulates of wood smoke measured inside impacted homes - emissions also include: carbon monoxide; respiratory irritants; volatile gases; carcinogens and neurotoxins.

Indoor Air Testing conducted by Environment and Human health, Inc. (EHHI)

- EHHI measured the two particle sizes designated by EPA to be the most dangerous to human health. They are PM 2.5 and PM 0.5. Both of these particulates were continually recorded in the impacted homes. Both hourly averages and minute by minute data were collected.
- Control houses were selected based on the absence of outdoor wood burning devices in their immediate neighborhood.

Information shown in the attached charts

1. Chart 1 shows the extremely high hourly average of particulate smoke levels inside the OWF impacted houses compared to control houses throughout the day starting at noon and extending through the night to the next noon. The intense levels begin at 6 to 8 pm and extend throughout the night -showing that the residents of these houses are breathing in wood smoke particulates all night while they are sleeping.

2. Charts 2 to 5 show the 3 days measured for each house tested. Periods of very high exposures are seen for both PM 2.5 and 0.5 particulates for every house for every day. There are some periods of the day when the impacted houses have their particulate matter recede – but most of the time there are elevated exposures which last for hours -- tending to peak in the middle of the night when residents are sleeping.

Health effects from the wood smoke inside houses.

I will restrict my comments to the health effects demonstrated to occur from breathing wood smoke in contaminated houses at the levels shown in the charts. First: There is no doubt that emissions from the OWFs are entering these homes.

Episodes of short-term exposures to extreme levels of fine particulates from wood smoke and other sources for periods as short as two hours produce significant adverse health effects.¹

Outdoor wood smoke contamination of houses is the primary cause of indoor exposures to wood smoke. Wood smoke is a mixture of particulate matter and organic chemicals of different toxicities - including cancer.

Outdoor wood furnaces create different emissions as they cycle between two different burning conditions --oxygen deficient and oxygen rich. Both of these cycles form particulates in the size-ranges measured..

Components of wood smoke are similar to cigarette smoke. Both are carcinogenic and respiratory toxins. Wood smoke contains fine particulate matter, carbon monoxide, formaldehyde, sulfur dioxide and various irritant gases such as nitrogen oxides that can scar the lungs. Wood smoke also contains chemicals known or suspected to be carcinogens, such as polycyclic aromatic hydrocarbons (PAHs) and dioxin.

Wood smoke interferes with normal lung development in infants and children. It increases children's risk of lower respiratory infections such as bronchitis and pneumonia. Wood smoke exposure can depress the immune system and damage the layer of cells in the lungs that protect and cleanse the airways.

Wood smoke causes coughs, headaches, eye, and throat irritation in otherwise healthy people. For vulnerable populations, such as people with asthma, chronic respiratory disease and those with cardiovascular disease, wood smoke is particularly harmful— even short exposures can prove dangerous.

The particles of wood smoke are extremely small and therefore are not filtered out by the nose or the upper respiratory system. Instead, these small particles end up deep in the lungs where they remain for months, causing structural damage and chemical changes. Wood smoke's irritants and carcinogenic chemicals which adhere to the tiny particles, enter deep sensitive regions of the lungs where the toxic injury is higher..

Fine particles, that go deep into the lungs, increase the risk of heart attacks and strokes. EPA warns that for people with heart disease, short- term exposures have been linked to heart attacks and arrhythmias. If you have heart disease, these tiny particles may cause chest pain, palpitations, shortness of breath, and fatigue.

Also present in the smoke emitted is carbon monoxide --- not only an immediate health risk but if exposures are continual can lead to neurological effects.

Children and the elderly have the highest sensitivity to wood smoke. However, no age group is without risk to respiratory problems including asthma and chronic obstructive pulmonary disease that result from breathing wood smoke. The effects are cumulative.

Science and risk in neighborhoods

A study by the University of Washington in Seattle showed that 50 to 70 percent of the outdoor levels of wood smoke were entering homes that were not burning wood. EPA did a similar study in Boise, Idaho, with similar results. The state of Washington has banned Outdoor Wood Boilers/Furnaces. The data in the charts also show that similar exposures are occurring in Connecticut.

The air impact of health exposure to wood smoke is increased two-fold during periods with stagnant air. Under those conditions, the inhaled dose levels of particulate within houses approach the hazardous level found in regulated work sites by OSHA. EHHL found smoke entering houses every day at even higher levels.

The particulate matter and gases in wood smoke are so small that windows and doors cannot keep them out—even the newer energy-efficient weather-tight homes cannot keep out wood smoke. This is consistent with reports from people in the EHHL study that their children awaken in the middle of the night having difficulty breathing.

Outdoor smoke from chimneys is diluted by air movement and high temperature but, wood smoke from OWF is cool. It remains at or falls to ground level and is trapped in the houses. It takes many hours to clear from the house. Importantly OWF smoke emissions by basic design are cooled by the water being heated in outdoor wood furnace's water jackets, the cooled smoke emissions stay at ground level and cannot dissipate for hours. Such cooling is fundamental to the design and function of the boiler. Ground level dispersion and collection is demonstrated in the numerous videos shown on the internet.

Connecticut's current regulatory approach has failed to address the health risks from OWFs. The approach has been enforcement through inspection and issuing of notices of violation when smoke is visible. That technique has failed to either detect violations of OWFs that occur at night or to determine the seriousness of the problem. **Moreover the hazardous fine particulates are not visible nor do they have an odor.** Further, the USEPA's and the state's cooperative effort with the industry to devise a "model rule" for the regulation of outdoor wood burning devices is also flawed and fails because the agencies and their industry collaborators have collected no information on the actual impact of the emissions inside homes. That is the case even though such data have been continuously requested by the exposed families for the last ten years.

SUMMARY

The use of Outdoor Wood Furnaces must be banned from Connecticut and the extent of the injuries must be determined for those families who have been continually exposed to these devices.

Health effects are known to occur at current ambient air levels of PM 2.5, in Connecticut that include increased asthma attacks in children, heart attacks, chronic obstructive lung disease and cancer. A report in the March 2009 issue of the peer reviewed "American Journal of Respiratory and Critical Care" published by the American Thoracic Society, show that reducing fine particulate in air reduced mortality risks. OWF emissions increase both PM 2.5 and fine particles inside impacted homes at far higher levels than found in ambient air as shown in the charts.

Pulmonary diseases and heart attacks increase after only a few hours of exposures to particulates in the air. It is important that the legislature be reminded that the contamination of air found in this study is several times higher than is found outdoors on even the most polluted days in Connecticut.

It is essential that Connecticut follow the lead of Washington State and ban the use of outdoor wood burning furnaces. It is equally necessary to take immediate steps to reduce the serious

exposures now occurring. Thank you for your time and I am prepared to answer any health questions that the committee may have.

David R. Brown, Sc.D.
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Adjunct Professor of Applied Ethics
Fairfield University

Note: The measuring instrument selected for the tests, Dylos Air Quality Meter, is designed to analyze particulate levels inside of buildings. The two particle sizes designated by EPA are the most dangerous to human health, PM 2.5 and PM fines are continuously recorded. The devices are reasonably priced and available to the public.

Brown, Callahan and Boissevain 2007 "An Assessment of Risk from particulate released from outdoor wood boilers" Human and Ecological Risk Assessment 13: 191-208 . "Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper." EPA-452/R-05-005, June 2005. Available at http://www.epa.gov/ttn/naaqs/standards/pm/data/pmstaffpaper_20050630.pdf; and Peters, A., D.W. Dockery, J.E. Muller, M.A. Mittleman. 2001. "Increased Particulate Air Pollution and the Triggering of Myocardial Infarction," *Circulation* 103:2810.

EPA Air Quality Index for PM 2.5 (with particulate counts scale estimate)

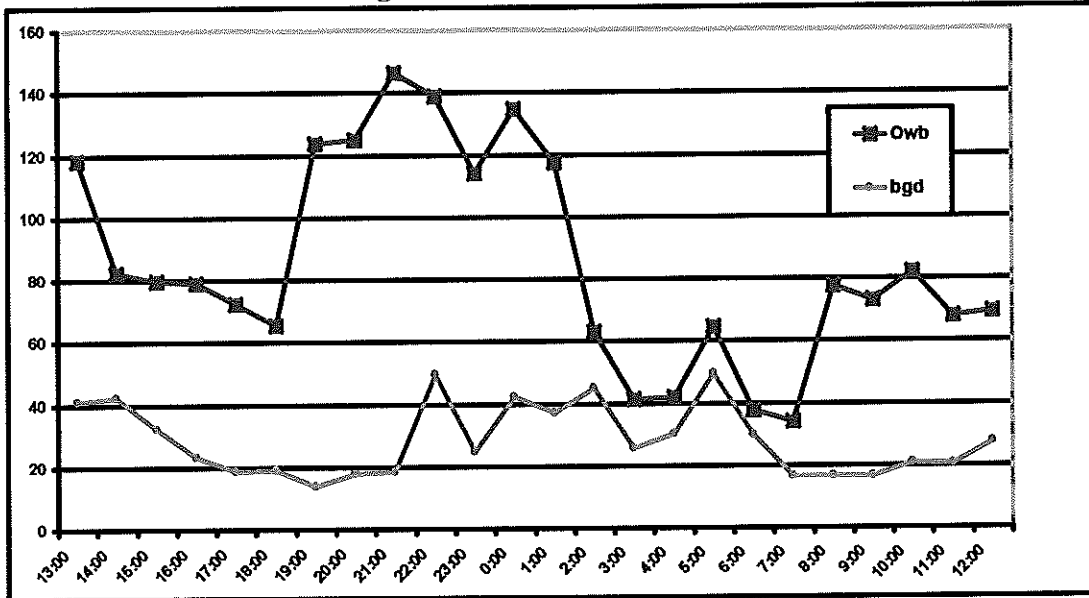
EPA has developed the Air Quality Index to compare health risks from exposures of less than 24 hour exposures.

<u>Air Quality</u>	<u>Exposure (ug/m3)</u>	<u>Exposure Particle (counts/ 0.01 ft3)</u>
Good	0 – 20	0 - 45
Moderate	21 – 40	45 - 95
Unhealthy for sensitive groups	41 – 60	95 - 140
Unhealthy for all	61 – 80	140 - 195
Very Unhealthy	81 - 120	over 195

Average Hourly Particle levels PM 2.5 micron inside of houses near outdoor wood boilers

Particles /0.01 cubic foot of air. OWB (N= 12) (3 days in 4 houses)

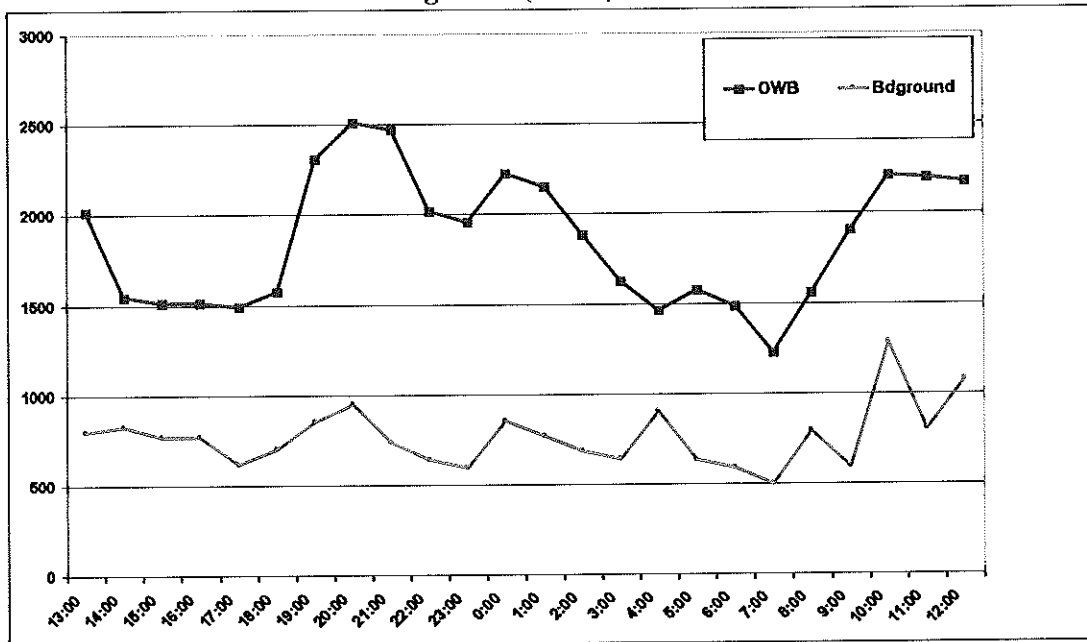
Background (N=13) 7 different houses



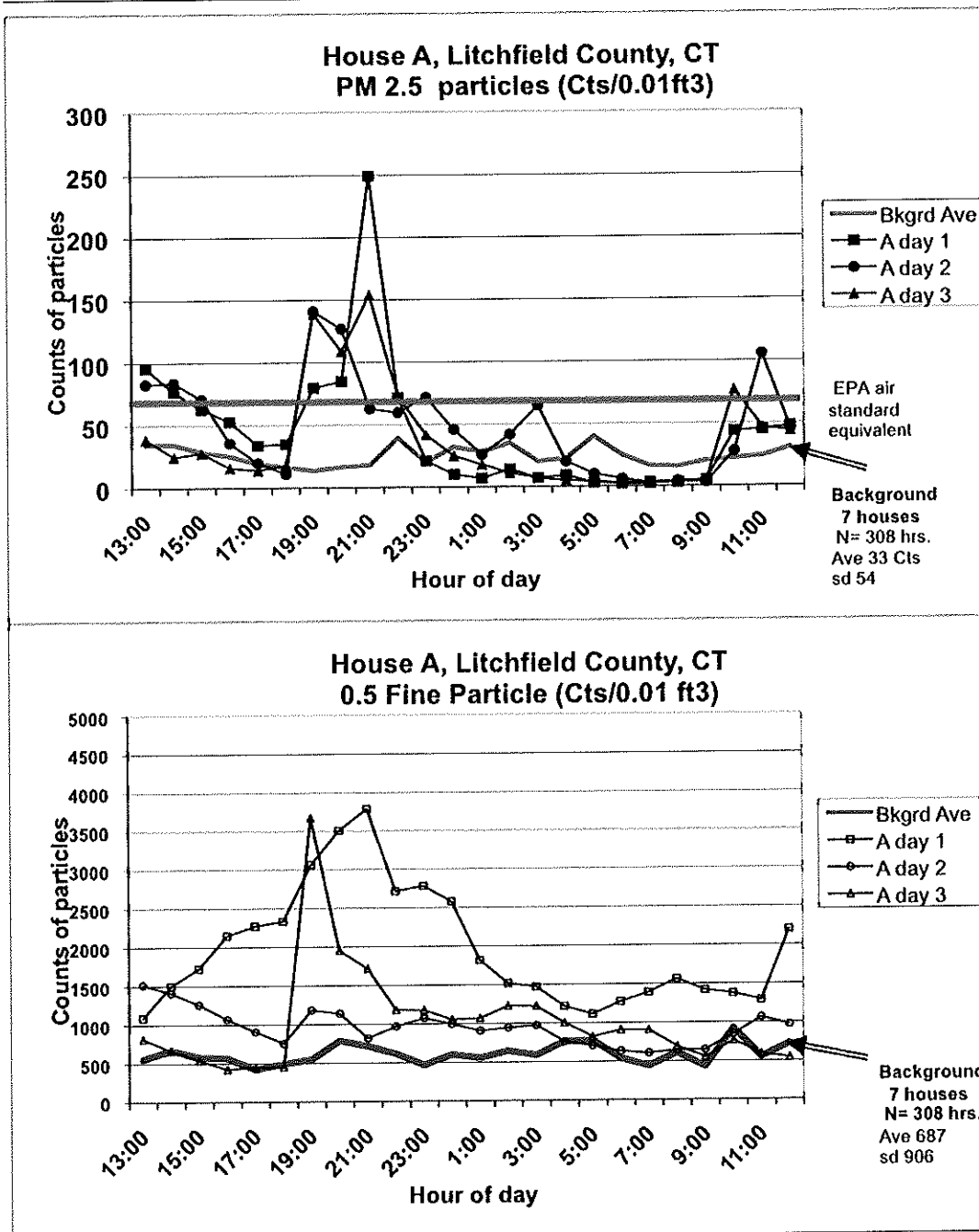
Average Hourly Fine particle levels PM 0.5 micron inside of houses near outdoor wood boilers

Particles /0.01 cubic foot of air. OWB (N= 12) (3 days in 4 houses)

Background (N=13) 7 houses

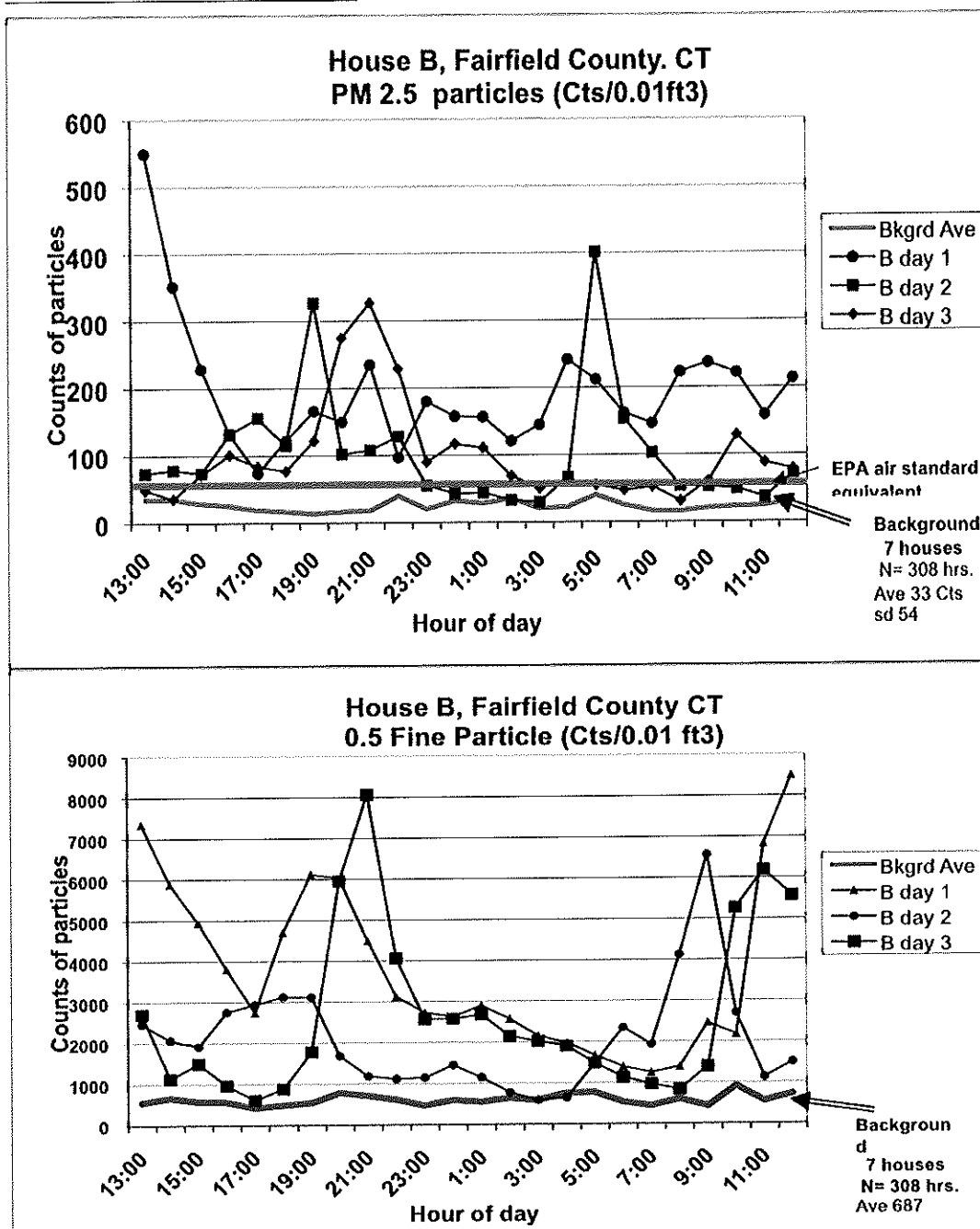


The above two charts show dangerously high levels of smoke particulates inside houses near OWBs at all hours of the day, especially at night, compared to normal houses.



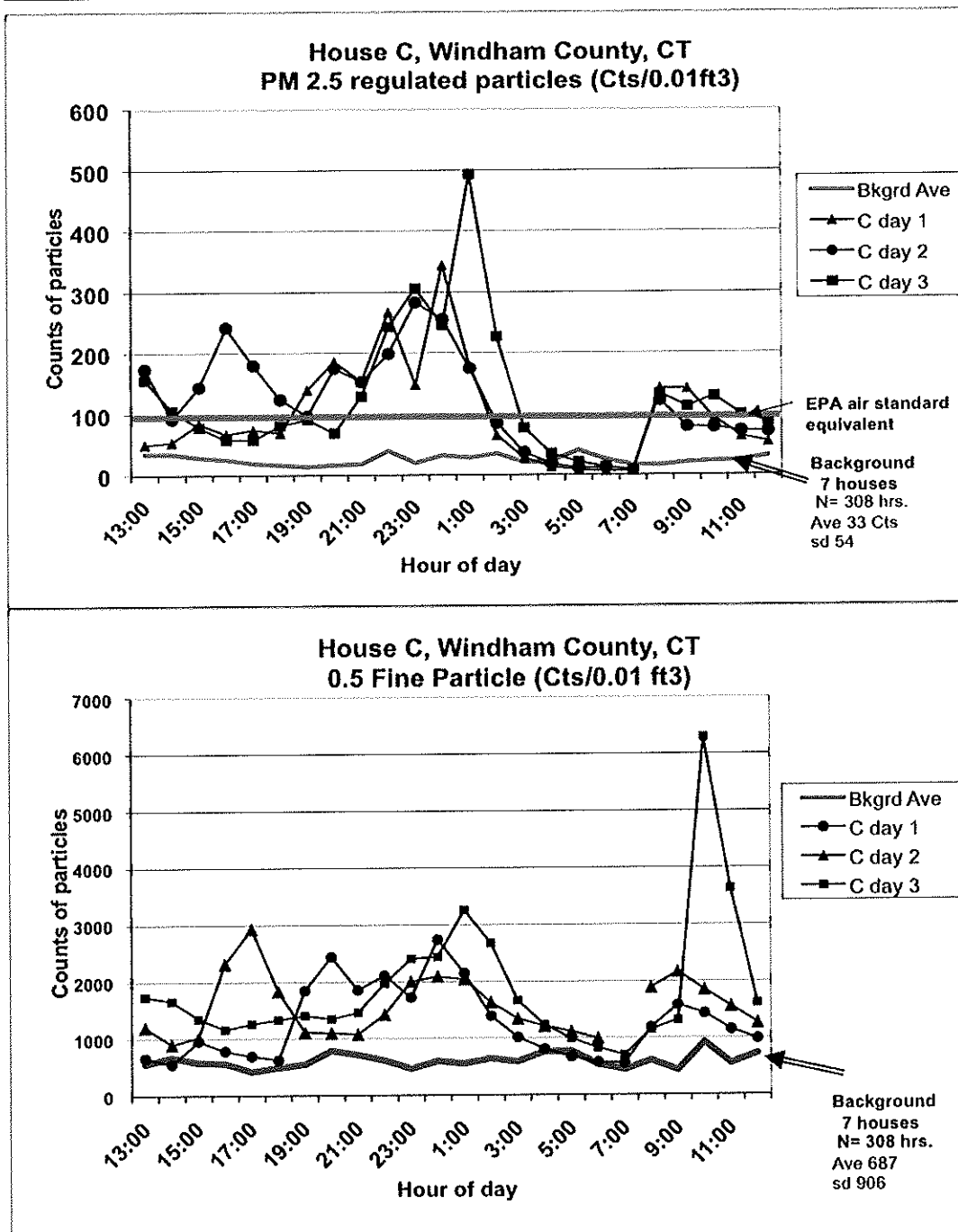
The charts above show hourly measurements over three consecutive days at House A (subjected to OWF smoke) as well as the average hourly measurements in houses *not* near OWFs. The straight horizontal line on the PM 2.5 chart (top) is equivalent to the EPA's ambient air quality standard. Levels of PM 2.5 that exceed the EPA standard are associated with asthma or COPD attacks and hospitalizations, and are also associated with increased risk of cardiac attacks.

These charts show dangerously high levels of smoke particulates inside the OWF impacted house at all hours of the day, especially at night, compared to normal houses.



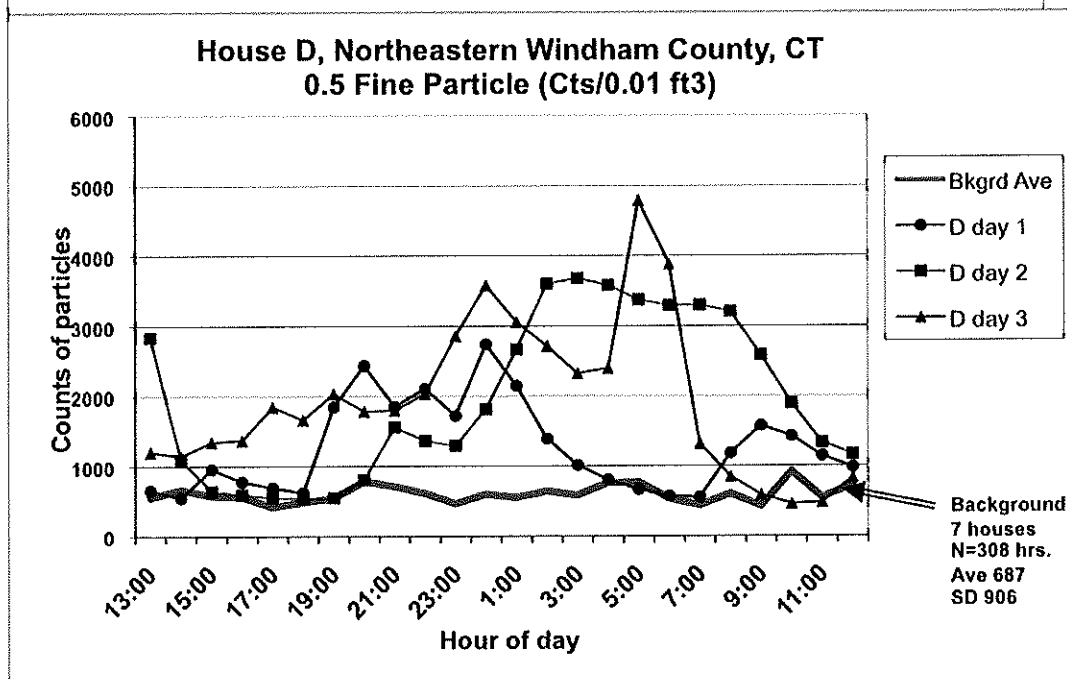
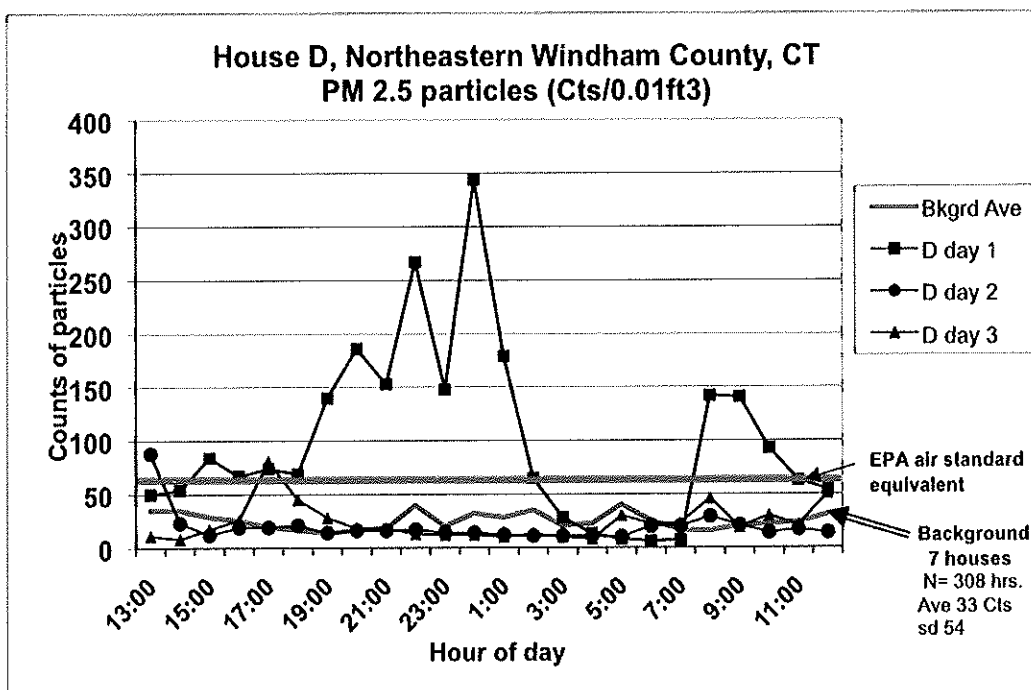
The charts above show hourly measurements over three consecutive days at House B (subjected to OWF smoke) as well as the average hourly measurements in houses *not* near OWFs. The straight horizontal line on the PM 2.5 chart (top) is equivalent to the EPA's ambient air quality standard. Levels of PM 2.5 that exceed the EPA standard are associated with asthma or COPD attacks and hospitalizations, and are also associated with increased risk of cardiac attacks.

These charts show dangerously high levels of smoke particulates inside the OWF impacted house at all hours of the day, especially at night, compared to normal houses.



The charts above show hourly measurements over three consecutive days at House C (subjected to OWF smoke) as well as the average hourly measurements in houses *not* near OWFs. The straight horizontal line on the PM 2.5 chart (top) is equivalent to the EPA's ambient air quality standard. Levels of PM 2.5 that exceed the EPA standard are associated with asthma or COPD attacks and hospitalizations, and are also associated with increased risk of cardiac attacks.

These charts show dangerously high levels of smoke particulates inside the OWF impacted house at all hours of the day, especially at night, compared to normal houses.



The charts above show hourly measurements over three consecutive days at House D (subjected to OWF smoke) as well as the average hourly measurements in houses *not* near OWFs. The straight horizontal line on the PM 2.5 chart (top) is equivalent to the EPA's ambient air quality standard. Levels of PM 2.5 that exceed the EPA standard are associated with asthma or COPD attacks and hospitalizations, and are also associated with increased risk of cardiac attacks.

These charts show dangerously high levels of smoke particulates inside the OWF impacted house at all hours of the day, especially at night, compared to normal houses.



Typical OWF emission cloud of emissions lack the heat needed to dissipate. The most dangerous components fine particulates and toxic gases are not visible. These components also stay at ground level and enter homes that are reached by the concentrated cloud of particulate and gases.